

ICS 29.180
CCS K 41

DL

**INDUSTRY STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

DL/T 2001-2019

**Guide for converter transformer on-site no-load test, load test
and temperature rise test
(English Translation)**

Issued on: June 4, 2019

Implemented on: October 1, 2019

Issued by: National Energy Administration

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Foreword

This standard is compiled in accordance with the rules given in GB/T 1.1-2009 "Guidelines for Standardization Work Part 1: Standard Structure and Compilation".

This standard was proposed by the China Electricity Council.

This standard is under the jurisdiction of the National High Voltage Test Standardization Sub-Technical Committee (DL/T C 02).

Drafting organizations of this standard. State Grid Hubei Electric Power Research Institute, China Electric Power Research Institute Co., Ltd., State Grid Henan Electric Power Company Electric Power Research Institute, Electric Power Industry Electrical Equipment Quality Inspection and Testing Center, China Southern Power Grid EHV Transmission Company, State Grid Shaanxi Electric Power Company Electric Power Research Institute, China Southern Power Grid Research Institute Co., Ltd., ABB Chongqing Transformer Co., Ltd., TBEA Xinjiang Transformer Factory, Baoding Tianwei Baobian Electric Co., Ltd., Xi'an Xidian Transformer Co., Ltd., Datang Hunchun Power Plant, Suzhou Huadian Electric Co., Ltd.

1 Scope

This standard specifies that oil-immersed converter transformers (hereinafter referred to as converter transformers) for high-voltage direct current transmission shall be used for on-site no-load, load and temperature rise tests Test methods, test equipment, and test results judgment basis.

This standard is applicable to the on-site no-load, load and temperature rise tests of single-phase two-winding converter transformers for high voltage DC transmission with voltage levels of $\pm 800\text{kV}$ and below Test.

Single-phase three-winding commutation transformer and $\pm 1100\text{kV}$ commutation transformer can be implemented by reference.

2 Normative references

The following documents are indispensable for the application of this standard. For dated reference documents, only the dated version applies to this standard quasi. For undated reference documents, the latest version (including all amendments) is applicable to this standard.

GB 1094.1-2013 Power Transformer Part 1: General Rules GB 1094.2-2013 Power Transformer Part 2: Temperature Rise of Liquid-immersed Transformer GB 1094.3 Power Transformer Part 3: Insulation level, insulation test and external insulation air gap GB/T 2900.95-2015 Electrotechnical terminology transformers, voltage regulators and reactors GB/T 7252 Guidelines for Analysis and Judgment of Dissolved Gases in Transformer Oil GB/T 16927.1 High Voltage Test Technology Part 1: General Definition and Test Requirements GB/T 16927.3 High Voltage Test Technology Part 3: Definition and Requirements of Field Test GB/T 18494.2-2007 Converter Transformer Part 2: Converter Transformer for HVDC Transmission JB/T 501-2006 Test Guidelines for Power Transformers

3 Terms and definitions

The following terms and definitions defined in GB/T 2900.95-2015, GB 1094.1-2013 and GB 1094.2-2013 apply to this standard quasi. For ease of use, some terms and definitions are repeated below.

No-load loss

When the rated voltage (tap voltage) at the rated frequency is applied to the terminals of one winding and the other windings are open, the active power absorbed power.

[GB 1094.1-2013, definition 3.6.1] 3.2 no-load current when the rated voltage (tap voltage) at the rated frequency is applied to the terminal of one winding, when the other windings are open, it flows through the winding wire the root mean square value of the current at the

circuit terminal.

[GB 1094.1-2013, definition 3.6.2] 3.3 Load loss in a pair of windings, when the rated current (tap current) flows through the line terminals of one winding and the other winding is short-circuited, the at this time, the other windings (if any) should be opened.

[GB 1094.1-2013, definition 3.6.3] 3.4 Total loss the sum of no-load loss and load loss.

[GB 1094.1-2013, definition 3.6.4] 3.5 Short circuit impedance at rated frequency and reference temperature, the equivalent series impedance between a winding terminal in a pair of windings determines this when the value is set, the terminal of the other winding is short-circuited, and the other winding (if any) is open.

[GB 1094.1-2013, definition 3.7.1] 3.6 Temperature rise the difference between the temperature of the component (location) under consideration (for example. the average temperature of the winding) and the temperature of the external cooling medium.

[GB 1094.2-2013, definition 3.3]

4 Symbols and names

The symbols and names of various variables in this standard are as follows.

I_1 ---- Rated current (A);

f_1 ---- Rated frequency, namely the fundamental frequency (Hz);

U ---- RMS voltmeter reading during no-load test (kV);

U' ---- Average voltmeter reading during no-load test (kV);

d ---- Waveform correction factor;

S ---- Regulating power supply capacity (kW);

I_0 ---- No-load current of the converter transformer (%);

S_n ---- The rated capacity of the converter transformer (kVA).

I_X ---- Load loss test current under frequency f_X (A);

I_{LN} ---- The root mean square value of the load current when the winding under consideration is running (A);

I_h ---- h harmonic current (A);

I_{eq} ---- The root mean square value of the load current sine current equivalent to the load loss of the winding in operation (A);

h ---- harmonic order;

U_r ---- Rated phase voltage on the side of converter transformer valve (kV);

P1 ---- Total load loss under fundamental frequency (kW);

PWE1 ---- Winding eddy current loss at fundamental frequency (kW);

PSE1 ---- The stray loss (kW) of structural parts (excluding windings) at the fundamental frequency;

PN ---- total operating load loss (kW);

fh ---- frequency of h harmonic (Hz);

FWE ---- additional coefficient of eddy current loss in winding;

FSE ---- additional coefficient of stray loss of structural parts;

kh ---- The ratio of current I_h to rated current I_1 ;

R ---- winding DC resistance (ohm) including internal lead;

Pkt ---- load loss under rated current (kW);

Ukt ---- short-circuit voltage at rated current (kV);

Pkt' ---- reduce the load loss measured under current (kW);

Ukt' ---- Reduce the short-circuit voltage (kV) measured under current;

5.1 Test purpose

The purpose of conducting no-load test, load test or temperature rise test on the converter transformer site is as follows.

a) By measuring the no-load loss and no-load current under the rated voltage, verify whether these two indicators are in accordance with the national standard or product technical agreement.

Check and diagnose the defects in the commutator transformer magnetic circuit within the allowable range of the discussion.

b) By measuring short-circuit impedance and load loss, verify whether these two indicators are in the national standard or product technical agreement, and at the same time in order to find the defects of the winding and magnetic leakage circuit structure through the experiment.

c) The commutation variable temperature rise test is to determine the top oil temperature rise and the average temperature rise of the windings to verify the maximum Whether the total loss and the equilibrium temperature of the cooling device meet the requirements of relevant standards.